

THE INVENTION CLAIMED IS:

1 1. A scheduler for a network processor, the
2 scheduler including a scheduling queue in which weighted
3 fair queuing is applied, the scheduling queue having a range
4 R, flows being attached to the scheduling queue at a
5 distance D from a current pointer for the scheduling queue,
6 the distance D being calculated for each flow according to
7 the formula $D = ((WF \times FS)/SF)$, where:

8 WF is a weighting factor applicable to a
9 respective flow;

10 FS is a frame size attributable to the respective
11 flow; and

12 SF is a scaling factor;
13 wherein the scaling factor SF is adjusted
14 depending on a result of comparing the distance D to the
15 range R.

16 2. The scheduler of claim 1, wherein SF is
17 increased if $D > R$.

18 3. The scheduler of claim 2, wherein SF is
19 increased if D exceeds R in regard to a predetermined number
20 of calculations of D.

21 4. The scheduler of claim 1, wherein SF is
22 decreased if $D < R/2$.

23 5. The scheduler of claim 4, wherein SF is
24 decreased if D is less than one-half R in regard to a
25 predetermined number of calculations of D.

1 6. The scheduler of claim 1, wherein $SF = 2^n$, n
2 being a positive integer.

1 7. A scheduler of claim 6, wherein n is
2 incremented to adjust SF .

1 8. The scheduler of claim 6, wherein n is
2 decremented to adjust SF .

1 9. A method of managing a scheduling queue in a
2 scheduler for a network processor, the scheduling queue
3 having a range R , flows being attached to the scheduling
4 queue at a distance D from a current pointer for the
5 scheduling queue, the distance D being calculated for each
6 flow according to the formula $D = ((WF \times FS)/SF)$, where:

7 WF is a weighting factor applicable to a
8 respective flow;

9 FS is a frame size attributable to the respective
10 flow; and

11 SF is a scaling factor;

12 the method comprising:

13 calculating the distance D with respect to a
14 particular flow to be enqueued;

15 comparing the distance D to the range R ; and

16 adjusting the scaling factor SF based on a result
17 of the comparing step.

1 10. The method of claim 9, wherein the scaling
2 factor SF is increased if the comparing step determines that
3 $D > R$.

1 11. The method of claim 9, wherein the scaling
2 factor SF is decreased if the comparing step determines that
3 $D < R/2$.

1 12. The method of claim 9, wherein $SF = 2^n$, n
2 being a positive integer, and the adjusting step includes
3 incrementing or decrementing n.

1 13. A method of managing a scheduling queue in a
2 scheduler for a network processor, the scheduling queue
3 having a range R, flows being attached to the scheduling
4 queue at a distance D from a current pointer for the
5 scheduling queue, the distance D being calculated for each
6 flow according to the formula $D = ((WF \times FS)/SF)$, where:

7 WF is a weighting factor applicable to a
8 respective flow;

9 FS is a frame size attributable to the respective
10 flow; and

11 SF is a scaling factor;

12 the method comprising:

13 calculating the distance D with respect to a
14 particular flow to be enqueued;

15 comparing the distance D to the range R;

16 incrementing a counter if the comparing step
17 determines that $D > R$; and

18 increasing SF if the incremented counter exceeds a
19 threshold.

1 14. The method of claim 13, wherein $SF = 2^n$, n
2 being a positive integer, and the increasing step includes
3 incrementing n.

1 15. A method of managing a scheduling queue in a
2 scheduler for a network processor, the scheduling queue
3 having a range R, flows being attached to the scheduling
4 queue at a distance D from a current pointer for the
5 scheduling queue, the distance D being calculated for each
6 flow according to the formula $D = ((WF \times FS)/SF)$, where:

7 WF is a weighting factor applicable to a
8 respective flow;

9 FS is a frame size attributable to the respective
10 flow; and

11 SF is a scaling factor;

12 the method comprising:

13 calculating the distance D with respect to a
14 particular flow to be enqueued;

15 comparing the distance D to the range R;

16 incrementing a counter if the comparing step
17 determines that $D < R/2$; and

18 decreasing SF if the incremented counter exceeds a
19 threshold.

20 16. The method of claim 15, further comprising:

21 clearing the counter if the comparing step
22 determines that $D > R/2$.

1 17. The method of claim 15, wherein $SF = 2^n$, n
2 being a positive integer, and the decreasing step includes
3 decrementing n.

1 18. A method of managing a scheduling queue in a
2 scheduler for a network processor, the scheduling queue

3 having a range R, flows being attached to the scheduling
4 queue at a distance D from a current pointer for the
5 scheduling queue, the distance D being calculated for each
6 flow according to the formula $D = ((WF \times FS)/SF)$, where:

7 WF is a weighting factor applicable to a
8 respective flow;

9 FS is a frame size attributable to the respective
10 flow; and

11 SF is a scaling factor;

12 the method comprising:

13 calculating the distance D with respect to a
14 particular flow to be enqueued;

15 comparing the distance D to the range R;

16 incrementing a first counter if the comparing step
17 determines that $D > R$;

18 increasing SF if the incremented first counter
19 exceeds a first threshold;

20 incrementing a second counter if the comparing
21 step determines that $D < R/2$; and

22 decreasing SF if the incremented second counter
23 exceeds a second threshold.

1 19. The method of claim 18, further comprising:
2 clearing the second counter if the comparing step
3 determines that $D > R/2$.

1 20. The method of claim 18, wherein $SF = 2^n$, n
2 being a positive integer, the increasing step includes
3 incrementing n, and the decreasing step includes
4 decrementing n.

1 21. A method of managing a scheduling queue in a
2 scheduler for a network processor, the scheduling queue
3 having a range R, flows being attached to the scheduling
4 queue at a distance D from a current pointer for the
5 scheduling queue, the distance D being calculated for each
6 flow according to the formula $D = ((WF \times FS)/SF)$, where:

7 WF is a weighting factor applicable to a
8 respective flow;

9 FS is a frame size attributable to the respective
10 flow; and

11 SF is a scaling factor;

12 the method comprising:

13 calculating the distance D with respect to a
14 particular flow to be enqueued;

15 comparing the distance D to the range R; and

16 increasing SF if the distance D exceeds the range
17 R.

1 22. A method of managing a scheduling queue in a
2 scheduler for a network processor, the scheduling queue
3 having a range R, flows being attached to the scheduling
4 queue at a distance D from a current pointer for the
5 scheduling queue, the distance D being calculated for each
6 flow according to the formula $D = ((WF \times FS)/SF)$, where:

7 WF is a weighting factor applicable to a
8 respective flow;

9 FS is a frame size attributable to the respective
10 flow; and

11 SF is a scaling factor;

12 the method comprising:

13 calculating the distance D with respect to a
14 particular flow to be enqueued;
15 comparing the distance D to the range R;
16 increasing SF if the distance D exceeds the range
17 R;
18 incrementing a counter if the comparing step
19 determines that $D < R/2$; and
20 decreasing SF if the incremented counter exceeds a
21 threshold.

1 23. A scheduler for a network processor, the
2 scheduler including:
3 a scheduling queue in which weighted fair
4 queuing is applied, the scheduling queue having a range R,
5 flows being attached to the scheduling queue at a distance D
6 from a current pointer for the scheduling queue, the
7 distance D being calculated for each flow according to the
8 formula $D = ((WF \times FS)/SF)$, where:
9 WF is a weighting factor applicable to a
10 respective flow;
11 FS is a frame size attributable to the
12 respective flow; and
13 SF is a scaling factor;
14 wherein the scheduler is adapted to:
15 calculate the distance D with respect to
16 a particular flow to be enqueued;
17 compare the distance D to the range R;
18 increment a counter if the comparison of
19 the distance D to the range R determines that $D > R$; and
20 increase SF if the incremented counter
21 exceeds a threshold.

1 24. A scheduler for a network processor, the
2 scheduler including:

3 a scheduling queue in which weighted fair
4 queuing is applied, the scheduling queue having a range R,
5 flows being attached to the scheduling queue at a distance D
6 from a current pointer for the scheduling queue, the
7 distance D being calculated for each flow according to the
8 formula $D = ((WF \times FS)/SF)$, where:

9 WF is a weighting factor applicable to a
10 respective flow;

11 FS is a frame size attributable to the
12 respective flow; and

13 SF is a scaling factor;

14 wherein the scheduler is adapted to:

15 calculate the distance D with respect to
16 a particular flow to be enqueued;

17 compare the distance D to the range R;

18 increment a counter if the comparison of
19 the distance D to the range R determines that $D < R/2$; and

20 decrease SF if the incremented counter
21 exceeds a threshold.

1 25. A scheduler for a network processor, the
2 scheduler including:

3 a scheduling queue in which weighted fair
4 queuing is applied, the scheduling queue having a range R,
5 flows being attached to the scheduling queue at a distance D
6 from a current pointer for the scheduling queue, the
7 distance D being calculated for each flow according to the
8 formula $D = ((WF \times FS)/SF)$, where:

9 WF is a weighting factor applicable to a
10 respective flow;
11 FS is a frame size attributable to the
12 respective flow; and
13 SF is a scaling factor;
14 wherein the scheduler is adapted to:
15 calculate the distance D with respect to
16 a particular flow to be enqueued;
17 compare the distance D to the range R;
18 increment a first counter if the
19 comparison of the distance D to the range R determines that
20 $D > R$;
21 increase SF if the incremented first
22 counter exceeds a first threshold;
23 increment a second counter if the
24 comparison of the distance D to the range R determines that
25 $D < R/2$; and
26 decrease SF if the incremented second
27 counter exceeds a second threshold.

28 26. A scheduler for a network processor, the
29 scheduler including:

3 a scheduling queue in which weighted fair
4 queuing is applied, the scheduling queue having a range R,
5 flows being attached to the scheduling queue at a distance D
6 from a current pointer for the scheduling queue, the
7 distance D being calculated for each flow according to the
8 formula $D = ((WF \times FS)/SF)$, where:

9 WF is a weighting factor applicable to a
10 respective flow;

11 FS is a frame size attributable to the
12 respective flow; and
13 SF is a scaling factor;
14 wherein the scheduler is adapted to:
15 calculate the distance D with respect to
16 a particular flow to be enqueued;
17 compare the distance D to the range R;
18 and
19 increase SF if the distance D exceeds
20 the range R.

1 27. A scheduler for a network processor, the
2 scheduler including:
3 a scheduling queue in which weighted fair
4 queuing is applied, the scheduling queue having a range R,
5 flows being attached to the scheduling queue at a distance D
6 from a current pointer for the scheduling queue, the
7 distance D being calculated for each flow according to the
8 formula $D = ((WF \times FS) / SF)$, where:
9 WF is a weighting factor applicable to a
10 respective flow;
11 FS is a frame size attributable to the
12 respective flow; and
13 SF is a scaling factor;
14 wherein the scheduler is adapted to:
15 calculate the distance D with respect to
16 a particular flow to be enqueued;
17 compare the distance D to the range R;
18 increase SF if the distance D exceeds
19 the range R;

20 increment a counter if the comparison of
21 the distance D to the range R determines that $D < R/2$; and
22 decrease SF if the incremented counter
23 exceeds a threshold.

1 28. A computer program product for use with a
2 scheduler for a network processor, the scheduler including:
3 a scheduling queue in which weighted fair
4 queuing is applied, the scheduling queue having a range R,
5 flows being attached to the scheduling queue at a distance D
6 from a current pointer for the scheduling queue, the
7 distance D being calculated for each flow according to the
8 formula $D = ((WF \times FS)/SF)$, where:
9 WF is a weighting factor applicable to a
10 respective flow;
11 FS is a frame size attributable to the
12 respective flow; and
13 SF is a scaling factor;
14 the computer program product comprising:
15 a medium readable by a computer, the computer
16 readable medium having computer program code adapted to:
17 calculate the distance D with respect to
18 a particular flow to be enqueued;
19 compare the distance D to the range R;
20 increment a counter if the comparison of
21 the distance D to the range R determines that $D > R$; and
22 increase SF if the incremented counter
23 exceeds a threshold.

1 29. A computer program product for use with a
2 scheduler for a network processor, the scheduler including:

3 a scheduling queue in which weighted fair
4 queuing is applied, the scheduling queue having a range R,
5 flows being attached to the scheduling queue at a distance D
6 from a current pointer for the scheduling queue, the
7 distance D being calculated for each flow according to the
8 formula $D = ((WF \times FS)/SF)$, where:

9 WF is a weighting factor applicable to a
10 respective flow;

11 FS is a frame size attributable to the
12 respective flow; and

13 SF is a scaling factor;
14 the computer program product comprising:

15 a medium readable by a computer, the computer
16 readable medium having computer program code adapted to:

17 calculate the distance D with respect to
18 a particular flow to be enqueued;

19 compare the distance D to the range R;

20 increment a counter if the comparison of
21 the distance D to the range R determines that $D < R/2$; and

22 decrease SF if the incremented counter
23 exceeds a threshold.

1 30. A computer program product for use with a
2 scheduler for a network processor, the scheduler including:
3 a scheduling queue in which weighted fair
4 queuing is applied, the scheduling queue having a range R,
5 flows being attached to the scheduling queue at a distance D
6 from a current pointer for the scheduling queue, the
7 distance D being calculated for each flow according to the
8 formula $D = ((WF \times FS)/SF)$, where:

9 WF is a weighting factor applicable to a
10 respective flow;

11 FS is a frame size attributable to the
12 respective flow; and

13 SF is a scaling factor;
14 the computer program product comprising:

15 a medium readable by a computer, the computer
16 readable medium having computer program code adapted to:

17 calculate the distance D with respect to
18 a particular flow to be enqueued;

19 compare the distance D to the range R;

20 increment a first counter if the
21 comparison of the distance D to the range R determines that
22 $D > R$;

23 increase SF if the incremented first
24 counter exceeds a first threshold;

25 increment a second counter if the
26 comparison of the distance D to the range R determines that
27 $D < R/2$; and

28 decrease SF if the incremented second
29 counter exceeds a second threshold.

1 31. A computer program product for use with a
2 scheduler for a network processor, the scheduler including:
3 a scheduling queue in which weighted fair
4 queuing is applied, the scheduling queue having a range R,
5 flows being attached to the scheduling queue at a distance D
6 from a current pointer for the scheduling queue, the
7 distance D being calculated for each flow according to the
8 formula $D = ((WF \times FS)/SF)$, where:

21 adjust the scaling factor SF based on a
22 result of the comparison of the distance D to the range R.

9 WF is a weighting factor applicable to a
10 respective flow;

11 FS is a frame size attributable to the
12 respective flow; and

13 SF is a scaling factor;

14 the computer program product comprising:

15 a medium readable by a computer, the computer
16 readable medium having computer program code adapted to:

17 calculate the distance D with respect to
18 a particular flow to be enqueued;

19 compare the distance D to the range R;

20 and

21 increase SF if the distance D exceeds
22 the range R.

32. A computer program product for use with a
scheduler for a network processor, the scheduler including:

3 a scheduling queue in which weighted fair
4 queuing is applied, the scheduling queue having a range R,
5 flows being attached to the scheduling queue at a distance D
6 from a current pointer for the scheduling queue, the
7 distance D being calculated for each flow according to the
8 formula $D = ((WF \times FS) / SF)$, where:

9 WF is a weighting factor applicable to a
10 respective flow;

11 FS is a frame size attributable to the
12 respective flow; and

13 SF is a scaling factor;

14 the computer program product comprising:

15 a medium readable by a computer, the computer
16 readable medium having computer program code adapted to:

17 calculate the distance D with respect to
18 a particular flow to be enqueued;
19 compare the distance D to the range R;
20 increase SF if the distance D exceeds
21 the range R;
22 increment a counter if the comparison of
23 the distance D to the range R determines that $D < R/2$; and
24 decrease SF if the incremented counter
25 exceeds a threshold.

1 33. A computer program product for use with a
2 scheduler for a network processor, the scheduler including:
3 a scheduling queue in which weighted fair
4 queuing is applied, the scheduling queue having a range R,
5 flows being attached to the scheduling queue at a distance D
6 from a current pointer for the scheduling queue, the
7 distance D being calculated for each flow according to the
8 formula $D = ((WF \times FS)/SF)$, where:
9 WF is a weighting factor applicable to a
10 respective flow;
11 FS is a frame size attributable to the
12 respective flow; and
13 SF is a scaling factor;
14 the computer program product comprising:
15 a medium readable by a computer, the computer
16 readable medium having computer program code adapted to:
17 calculate the distance D with respect to
18 a particular flow to be enqueued;
19 compare the distance D to the range R;
20 and